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Brief

Research Investigation 97-028
SPR Study 97-7

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Application of Innovative Geophysical Methods for Subgrade Investigations

(Nondestructive Testing)

Research Development and Technology Division

Missouri Department of Transportation

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Description:

Geophysical surveys were conducted for the Missouri Department of Transportation (MoDOT) by the Department of Geology and Geophysics at the University of Missouri-Rolla to determine the most probable cause or causes of ongoing subsidence along a distressed section of Interstate 44 in Springfield, Missouri. The Springfield area is associated with sinkholes and karst terrain. This particular section of highway had experienced gradual, but continual subsidence that was visually detectable on the both the shoulders and median. A sudden 1 meter diameter, 2.5 meter deep collapse on the shoulder signified the need of a rapid subgrade assessment procedure to ensure the safety of the traveling public. Ground penetrating radar (GPR) and shallow reflection seismic technologies were applied to the site immediately.

Procedure:

Ground penetrating radar profiles were acquired along the concrete paved sections of the interstate. The intent was to image the shallow subsurface in detail to a depth of 4 meters. The goal was to identify any voids or unconsolidated material below the roadway.

Seven reflection seismic profiles were acquired along and near Interstate 44. The intent of the seismic acquisition was to image the shallow subsurface (especially bedrock) to a depth of about 60 meters. The profiles were to show the bedrock structural / lithologic patterns in the area to allow a better understanding of the subsidence features and regional drainage.

Advantage:

GPR and reflection seismic quickly assess roadway and subsurface conditions with nondestructive, continuous profiles. They expedited both the investigation and mitigation of karst related voids. Typical investigative methods include the drilling of numerous auger holes or removing the pavement completely in the suspect area. Drill holes provide only point specific data and compromise the integrity of the pavement. If pavement is bridging a subsurface void, destructive methods can be especially dangerous.

Results:

The geophysical surveys were successful. The GPR proved to be of useful utility in defining upward-propagating voids in embankment fill material. On the basis of interpretation of these data, MoDOT personnel were able to drill into the voids that had developed beneath the pavement (as a result of washing out of the fine-grained material of the embankment fill), and to devise an effective grouting plan for stabilization of the roadway.

- The reflection seismic survey established the presence of reactivated paleosinkholes in the area, that had developed along essentially north-northwest trending fault/fracture zones. These were responsible for swallowing the fill material as water drained through the embankment.

The site was later revisited for confirmation of the effectiveness of the stabilization of the grouting plan. Duplicate GPR profiles were acquired and indicated tha the grouting program had been effective and that no substantial voids had developed in the interim.

Contact:

If you would like a copy of the full report, please contac Jim Radmacher with the Missouri Department of Transportation by telephone at (573) 751-0852 or by e-mail at radmaj@mail.modot.state.mo.us

Please refer to Research Investigation 97-028.

If you would like further information on the details of this study, please contact Tim Newton with the Missouri Department of Transportation by telephone at (573) 526 4343 or by e-mail at newtot@mail.modot.state.mo.us